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IS 14605 (1998, Reaffirmed 2009): Irrigation Equipment--Micro Sprayers--Specification. ICS 65.060.35

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Indian Standard

IRRIGATION EQUIPMENT — MICRO SPRAYERS — SPECIFICATION

ICS 65.060.35

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 1998 **Price Group 4**

Irrigation and Farm Drainage Equipment and System Sectional Committee, FAD 54

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Irrigation and Farm Drainage Equipment and System Sectional Committee had been approved by the Food and Agriculture Division Council.

Micro sprayers are now increasingly used for irrigation purpose. A need was therefore felt to prepare a specification for micro sprayer for producing quality product by the manufacturer and for selecting appropriate micro sprayers by the user.

In the preparation of this standard considerable assistance has been derived from ISO 8026 : 1995 'Agricultural irrigation equipment — Sprayers — General requirements and test methods', published by the International Organization for Standardization.

This standard deviates from ISO 8026 : 1995 on the following points:

a) Temperature for various tests has been changed from 25°C ± 5°C to 27°C ± 2°C.

b) Minimum torque for testing the resistance of threaded connections has been reduced from 7 N-m to 4 N-m as committee felt that 7 N-m is difficult to achieve for plastic materials available in the country.

c) Test of resistance to hydrostatic pressure at high temperature and that for trajectory height has been excluded due to problems in testing.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding of numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

IRRIGATION EQUIPMENT — MICRO SPRAYERS — SPECIFICATION

1 SCOPE

1.1 This standard specifies the general requirements and test methods for micro sprayers.

1.1.1 It applies to sprayers intended for assembly in pipeline networks for irrigation and for operation with irrigation water.

2 REFERENCES

The following Indian Standards contain provisions which, through reference in this text, constitute provisions of this Indian Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Indian Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
554 : 1985	Dimensions for pipe threads where pressure-tight joints are required on the threads (*third revision*)
2500	Sampling inspection procedures:
(Part 1) : 1992	Attributes sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection (*second revision*)
(Part 2) : 1965	Inspection by variables for percent defective
12232 (Part 2) : 1995	Irrigation equipment — Rotating sprinkler: Part 2 Test method for uniformity of distribution (*first revision*)

3 DEFINITIONS

For the purpose of this standard, the following definitions shall apply.

3.1 Irrigation Sprayer

Device which sprays water with or without rotational movement of the sprayer parts, in the form of fine jets or in a fan shape.

3.2 Regulated Sprayer, Pressure-Compensated Sprayer

Sprayer with a relatively constant flow rate at varying water pressures at the sprayer inlet in-built with the sprayer or fitted separately within the limits specified by the manufacturer as the regulating range (*see* **3.5**).

3.3 Non-regulated Sprayer, Non-pressure-Compensating Sprayer

Sprayer with a variable flow rate at varying water pressures at the sprayer inlet.

3.4 Nominal Flow Rate

Quantity of water discharged by a sprayer with a specified nozzle per unit of time at ambient temperature at the test pressure declared by the manufacturer in the manufacturer's data sheets.

3.5 Regulating Range

Range of pressure at the inlet of a regulated sprayer within which the sprayer is designed to operate and discharge within 5 percent of its nominal flow rate (*see* **3.4**).

3.6 Test Pressure (p)

a) 200 kPa at the sprayer inlet.
b) Any pressure at the sprayer inlet, specifically declared by the manufacturer to be a test pressure.

3.7 Minimum Working Pressure (P_{Min})

Lowest working pressure declared by the manufacturer measured near the base of the sprayer at a point situated about 0.2 m below the main nozzle of the sprayer but with the pressure gauge situated in the same plane as the main nozzle (*see* Fig. 1).

3.8 Maximum Working Pressure (P_{Max})

Highest working pressure declared by the manufacturer measured near the base of the sprayer at a point situated about 0.2 m below the main nozzle of the sprayer but with the pressure gauge situated in the same plane as the main nozzle (*see* Fig. 1).

3.9 Range of Working Pressure

Pressure range between the minimum working pressure, P_{Min} and the maximum working pressure, P_{Max} declared by the manufacturer as the pressure range in which the sprayer operates effectively (*see* Fig. 2).

3.10 Ambient Temperature

Temperature of the surroundings.

3.11 Spray Coverage Pattern

Area wetted by the sprayer and described by geometric or an angular part-circle pattern.

NOTE — This may be, for example, rectangular, full-circle, 360° pattern, half-circle, 180° pattern; two circular sectors, such as the sector between 0° and 90° and the sector between 180° and 270°, and strip type wetting sprays are also available.

3.12 Water Distribution Curve

Curve of application rates measured in collectors laid out along the wetted radius, as a function of the distances of the collectors from the sprayer.

3.13 Radius of Throw

Farthest distance measured from the sprayer centerline to the point at which the sprayer deposits water at the minimum rate of 0.25 mm/h for a sprayer whose discharge exceeds 75 l/h, and 0,13 mm/h for a sprayer whose discharge is equal to or less than 75 l/h, typically measured at any arc of coverage except at the arc extremes for part-circle sprayers.

NOTE — The respective values relate only to sprayers in continuous operation.

3.14 Diameter of Coverage

Twice the radius of throw (*see* **3.13**).

3.15 Water Outlet Height

Height above ground level of the water outlet from the sprayer when the sprayer is installed as indicated in the manufacturer's instructions.

3.16 Nozzle

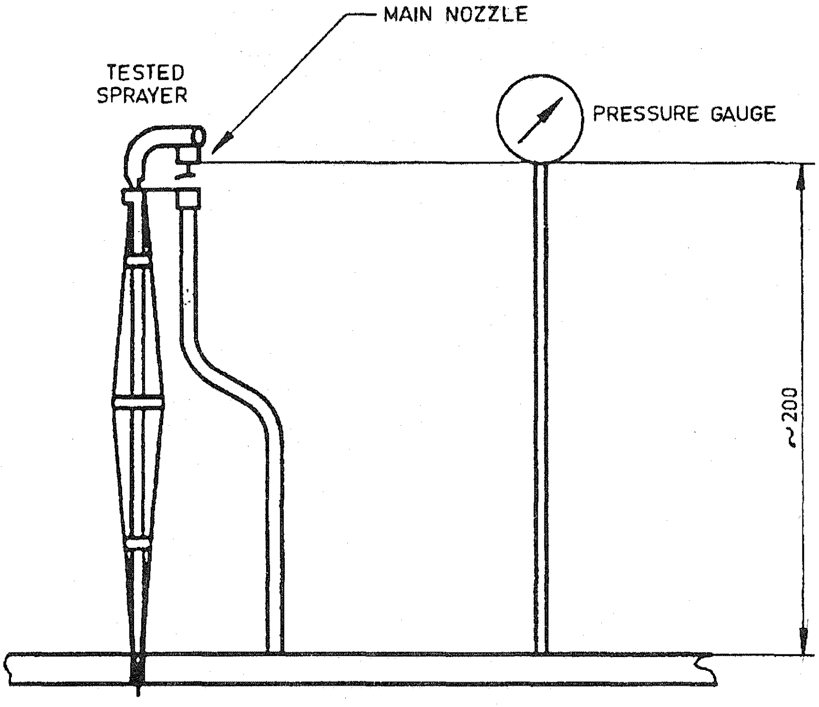
Aperture of the sprayer through which the water spray is discharged.

3.17 Collector

Receptacle into which the water discharged by the sprayer is deposited during the test for spray distribution.

3.18 Irrigation Lateral

Branch supply line on which water distribution devices (sprayers, emitters, drippers) are mounted directly or by means of a suitable fitting, riser or tube.



All dimensions in millimetres.

FIG. 1 MEASUREMENT OF SPRAYER PRESSURE

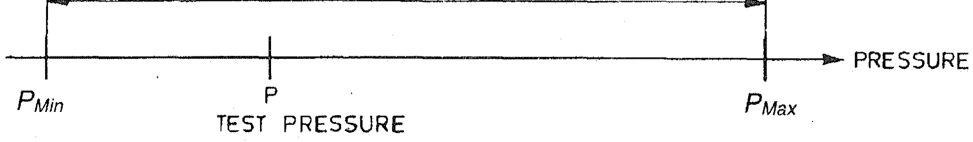


FIG. 2 RANGE OF EFFECTIVE PRESSURE

4 CLASSIFICATION

Sprayers are classified in two ways (*see* **4.1** and **4.2**).

4.1 Performance Characteristics (Flow Rate in Relation to Pressure)

4.1.1 *Regulated Sprayers*

4.1.2 *Non-regulated Sprayers*

4.2 Spray Characteristics

4.2.1 Relatively uniform spray coverage pattern in all directions as, for example, the pattern of some full-circle 360° sprayers with a fan-shape coverage pattern.

4.2.2 Non-uniform spray coverage pattern, as, for example, that obtained from fine jet sprayers.

5 GENERAL REQUIREMENTS

5.1 Materials

Sprayers shall be made of metals or plastics. Metal sprayers shall be made from stainless steel or alloys of copper, aluminium and zinc.

Plastics parts of the sprayers which conduct water and which are exposed to sunlight shall be opaque. Plastics parts of sprayers exposed to ultraviolet (UV) radiation shall contain an additive resistant to UV radiation.

On request, the manufacturer shall provide information as to the resistance of the sprayer to chemicals used in agriculture.

5.2 Construction and Workmanship

5.2.1 Individual parts of a sprayer shall show no visible cracks, holes, air bubbles or other defects that may impair the performance and durability of the sprayer, its operation and suitability for installation.

The surfaces of the sprayer shall be smooth and free from projections or sharp edges that may cause injury or poor operation.

5.2.2 If the construction of the sprayer permits replacement or change of parts (for example, the nozzle), it shall be possible to replace the parts with standard tools; if special tools are required, the manufacturer shall be capable of supplying them.

5.2.3 The design and manufacture of the sprayer shall enable proper operation of the sprayer when installed and operated in accordance with the manufacturer's instructions.

5.2.4 Metal sprayers intended for threaded connection (*see* **6.3**) to a pipeline or to risers shall be equipped with a hexagon, two parallel surfaces, or some other configuration suitable for gripping with a standard open or adjustable wrench. Sprayers having a plastics part for connection to risers may have other configurations (projections, slots, etc) to facilitate manual assembly and removal.

5.3 Threaded Connections

For sprayers designed for threaded connection to pipelines, the screw threads shall comply with IS 554. Alternatively, other threads may be allowed provided that a suitable adapter shall be supplied with each threaded connection, making it comply with IS 554.

6 GENERAL TEST CONDITIONS

6.1 General

Unless otherwise noted, perform the tests with water at a temperature of 27 ± 2°C.

6.2 Sampling and Acceptance Requirements

6.2.1 *Type Tests*

Take the test specimens at random from a quantity of at least 500 sprayers. The number of test specimens required for each test shall be as specified in Table 1.

If the number of defective specimens in the sample is equal to or less than the acceptance number specified in Table 1, the sample shall be considered as complying with the requirements of this Indian Standard. If the number of defective specimens in the sample is greater than the acceptance number, the sample shall be considered as not complying with the requirements of this Indian Standard.

6.2.2 *Acceptance Tests*

When acceptance of manufacturing lots or shipments is required, perform the sampling in accordance with IS 2500 (Part 1), based on acceptable quality level (AQL) 2.5 and special inspection level S-4.

Test all test specimens in the sample, selected at random as provided for in Table II A of IS 2500 (Part 1) as specified in **8.2**.

The shipment or manufacturing lot complies with this Indian Standard if the number of defective specimens found in the test does not exceed the acceptance number specified in IS 2500 (Part 1).

For the other tests, select the test specimen at random to conform with the number specified in Table 1.

The shipment or manufacturing lot is considered to comply with this Indian Standard if the number of defective specimens found in the other tests does not exceed the acceptance number specified in Table 1.

It is not necessary to perform the tests in **8.4** and **9** within the framework of the acceptance tests if type test has been carried out for the same sprayer model and provided that the manufacturer has not introduced structural changes in the sprayer since the type test.

Table 1 Required Number of Test Specimens and Acceptance Number

(*Clauses* 6.2.1 *and* 6.2.2)

Sl No.	Name of Test	Clause No.	No. of Test Specimens	Acceptance No.
(1)	(2)	(3)	(4)	(5)
i)	Construction and workmanship	5.2	10	1
ii)	Resistance of threaded connections	7.1	10	1
iii)	Resistance to hydrostatic pressure at ambient temperature	7.2	5	0
iv)	Uniformity of flow rate	8.2	1)	1)
v)	Performance characteristics	8.3	5	2)
vi)	Water distribution curves	8.4.2	3	2)
vii)	Diameter of coverage	8.4.3	3	2)
viii)	Spray coverage pattern	8.4.4	3	2)
ix)	Durability	9	5	1

1) Number of test specimens and acceptance conditions in accordance with IS 2500 (Part 2).

2) Acceptance conditions as specified in the relevant clause.

The manufacturer shall give proof that no changes have been made in the product to obviate the need to perform type tests.

6.3 Accuracy of Measuring Devices

The allowable deviation of the measuring devices from their true values shall be as follows:

Pressure : ± 2 percent
Flow rate : ± 1 percent

7 STRENGTH TESTS

Test sprayers while attached to an irrigation lateral, test sprayers of the same type, but with different means of attachment, separately for each combination for sprayer and means of attachment as recommended by the manufacturer for suitable connection.

7.1 Test of Resistance of Threaded Connections

For sprayers made of metal, the threaded connection shall withstand a torque of 20 N-m without showing signs of damage. For sprayers made of plastics, the threaded parts shall withstand a torque of 4 N-m, applied for 1 h, without showing signs of damage.

7.2 Test of Resistance to Hydrostatic Pressure at Ambient Temperature

7.2.1 Connect the sprayer to the test rig according to the recommendation of the manufacturer for field assembly and plug the nozzle such that no leakage occurs at the connection during the test.

Check that no air remains in the system, then gradually increase the water pressure in stages of 100 kPa, holding the system pressure for 5 seconds at each pressure stage.

Increase the water pressure gradually from zero up to 1.2 times the maximum working pressure, P_{Max} and maintain the pressure for a period of 1 h.

7.2.2 The sprayer and its parts shall withstand the test pressure without being damaged, no leakage shall occur through the sprayer body or its connections and the sprayer shall not separate from the assembly.

8 FUNCTIONAL AND OPERATIONAL TESTS

8.1 General Test Conditions

8.1.1 Perform the tests on sprayers which have previously been examined visually (without disassembly) for satisfactory workmanship and quality.

Attach test sprayers to the supply line according to the recommendations of the manufacturer for field assembly.

Test sprayers of the same type, but with different nozzles or different means of attachment separately for each combination of sprayer and nozzle, on sprayer and means of attachment.

Prior to conducting the functional and operational tests, operate each test sprayer for 1 h at the test pressure.

8.1.2 The test liquid shall be water that has passed through a filter with a mesh as recommended by the manufacturer for normal field conditions; in the absence of such recommendations, the water used shall be passed through a filter with apertures of 0.4 mm.

Unless otherwise noted, tests shall be performed with water at ambient temperature.

8.2 Uniformity of Flow Rate

8.2.1 Measure the flow rate of a test sprayer at the test pressure.

8.2.2 The sprayers tested shall meet the sample requirements of IS 2500 (Part 2) for an acceptable lower quality level (AQL) of 2.5 percent and shall have upper and lower specification limits as follows:

a) 10 percent for regulated sprayers (*see* **4.1.1**).
b) 7 percent for non-regulated sprayers (*see* **4.1.2**).

8.3 Performance Characteristics

8.3.1 *General*

Arrange the sprayers tested in **8.2** in ascending order according to their measured flow rate, and number them from 1 to n, with 1 being the number of the sprayer with the lowest flow rate and n that with the highest flow rate.

Select the four sprayers with numbers 2; $(n/2)-1$; $(n/2)+1$; and $n-1$ for further testing.

NOTE — If n is an odd number, round $(n/2)$ downwards to a whole number.

Measure the flow rate when the pressure varies from 0.8 P_{Min} to 1.2 P_{Max} by constant increments not greater than 50 kPa. Plot the results on a curve of flow rate as a function of pressure at the inlet.

8.3.2 *Regulated Sprayers*

8.3.2.1 When measuring the flow rate of regulated sprayers, record the results and determine the maximum flow rate, q_{Max} and the minimum flow rate, q_{Min} from among the different flow rates within the regulating range for each sprayer.

Calculate the average flow rate, q, from the results obtained for the four sprayers.

8.3.2.2 The maximum and minimum flow rates, q_{Max} and q_{Min} shall not deviate by more than ±10 percent from the nominal flow rate, q_{nom} within the regulation range. The average flow rate, q, shall not deviate by more than ± 2.5 percent from the nominal flow rate, q_{nom}.

8.3.3 *Non-regulated Sprayer*

8.3.3.1 When testing non-regulated sprayers, calculate the average of the flow rates, q, obtained for the four sprayers at a specified pressure. Plot the values obtained for the average flow rate graphically as a function of the pressure.

8.3.3.2 The performance characteristics (flow rate as a function of pressure) shall conform to the performance characteristics shown in the manufacturer's data sheets within a permissible deviation of ±10 percent.

8.4 Water Distribution Curves, Diameter of Coverage and Spray Coverage Pattern

8.4.1 Perform this test only for sprayers designated as Class 4.2.1.

Perform the test indoors, in draught free conditions, or in an outdoor area under no-wind conditions.

8.4.1.1 Level the test area evenly and divide it into squares with maximum side dimensions of 0.5 m for sprayers with an effective diameter of coverage of up to 6 m and with maximum side dimensions of 1.25 m for sprayers with an effective diameter of coverage greater than 6 m. Place collectors for collecting the water discharged by the test sprayer at the corners of each square (*see* Fig. 3).

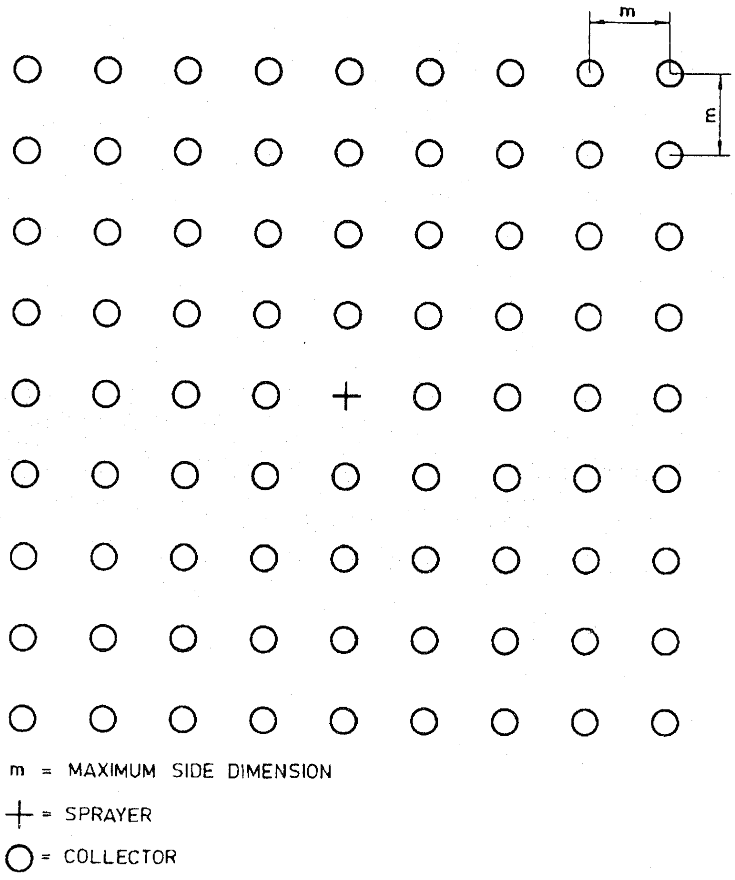


FIG. 3 FIELD ARRANGEMENT FOR TESTING OF WATER DISTRIBUTION AND DIAMETER OF COVERAGE

For testing sprayers that apply the water to a sector of a circle, placement of the collectors may be limited to the wetted sector only, with the sprayer located at the geometrical center of the sector.

8.4.1.2 The design of collectors shall be as specified in **4.1.2** of IS 12232 (Part 2). When installed, the openings of all the collectors shall be in the same horizontal plane. The number of collectors shall be sufficient to cover the entire spray coverage area.

8.4.1.3 Remove one collector from the centre of the test area and install the test sprayer in its place such that its spray is discharged at a height of 20 cm above the openings of collectors (*see* Fig. 4), unless the manufacturer recommends a height other than 20 cm. Ensure that the riser is fixed vertically and it does not bend or deviate from the deviation from the vertical during test. The maximum allowable deviation from the vertical during test shall not exceed 1°. All tests should be carried out at no wind condition.

8.4.2 *Water Distribution Curves*

8.4.2.1 Operate the sprayer for a minimum period of 1 h while maintaining the test pressure at the inlet of the sprayer.

Immediately on conclusion of the test, measure the quantity of water collected in each of the collectors placed along two radii (preferably at right angles to each other) within the spray coverage area (*see* Fig 3).

Calculate the water application rate, h, in mm/h from the following equation:

$$h = \frac{V \times 10}{A} \times \frac{1}{t}$$

where

V = volume, in cubic centimetres, collected in each collector;

A = area, in square centimetres, of the collector opening; and

t = test duration, in hours.

Plot the water distribution curves for all the collectors which were measured as a function of the distance of each collector from the sprayer along the two radii. Calculate and plot the average water distribution curve of depths of water application rate from the above two curves (*see* Fig. 5).

8.4.2.2 The average water distribution curve of the depths of water accumulated in the collectors (the distribution curve) shall conform to the curve supplied by the manufacturer within a permissible deviation of ± 15 percent.

8.4.3 *Diameter of Coverage*

8.4.3.1 Measure the distance along two radii from the sprayer to the most remote point at which the sprayer deposits water along the two radii at the minimum rate of 0.25 mm/h for a sprayer whose discharge exceeds 75 1/h, and at the minimum rate of 0.13 mm/h for a sprayer whose discharge is equal to or less than 75 1/h, typically measured at any arc of coverage except at the arc extremes for part-circle sprayers.

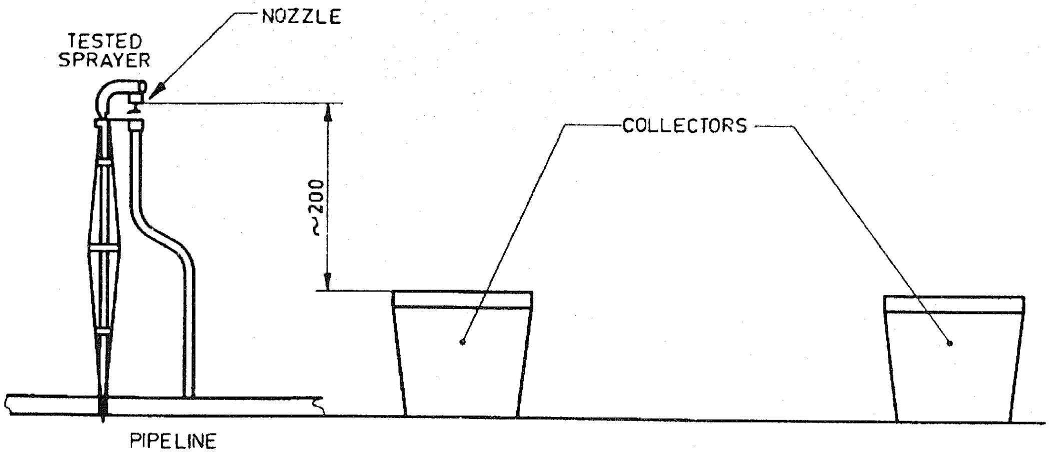
The diameter of coverage is the average of the two distances multiplied by 2.

8.4.3.2 The diameter of coverage shall conform to the values supplied by the manufacturer within a permissible deviation of ± 10 percent.

8.4.4 *Spray Coverage Pattern*

8.4.4.1 Operate the sprayer for a minimum period of 1 h while maintaining the test pressure at the inlet of the sprayer.

Immediately on conclusion of the test, measure the quantity of water collected in each of the collectors in



All dimensions in millimetres.

FIG. 4 SPRAYER ARRANGEMENT FOR WATER DISTRIBUTION TEST

the spray coverage area and mark their values on graph paper. Plot the curves (isograms) by connecting the interpolated points of equal collection rates (*see* Fig. 6).

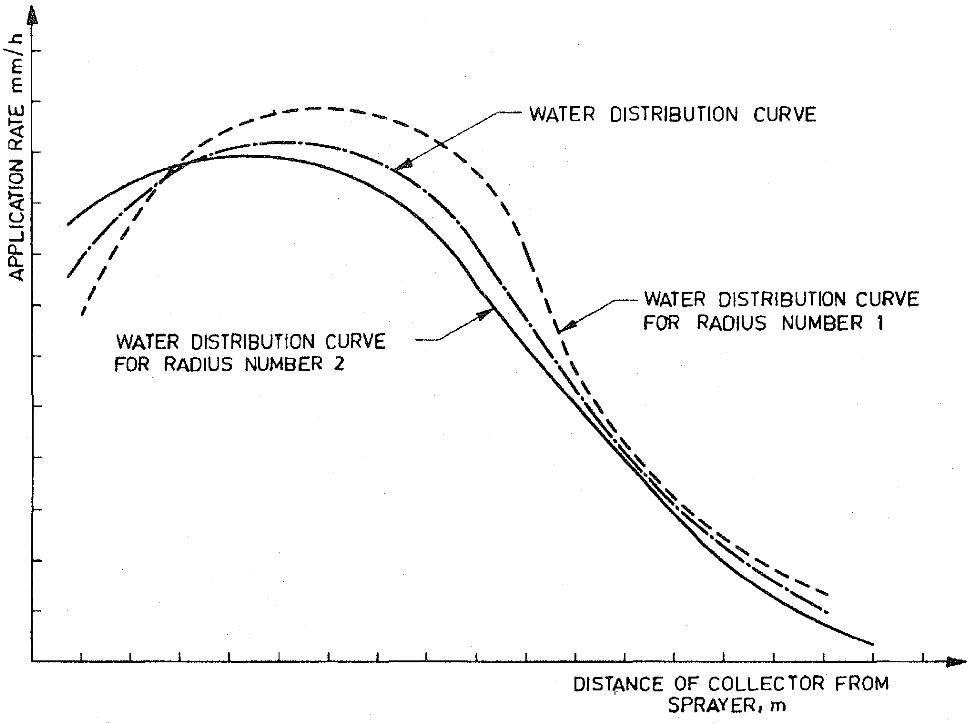


FIG. 5 WATER DISTRIBUTION CURVES

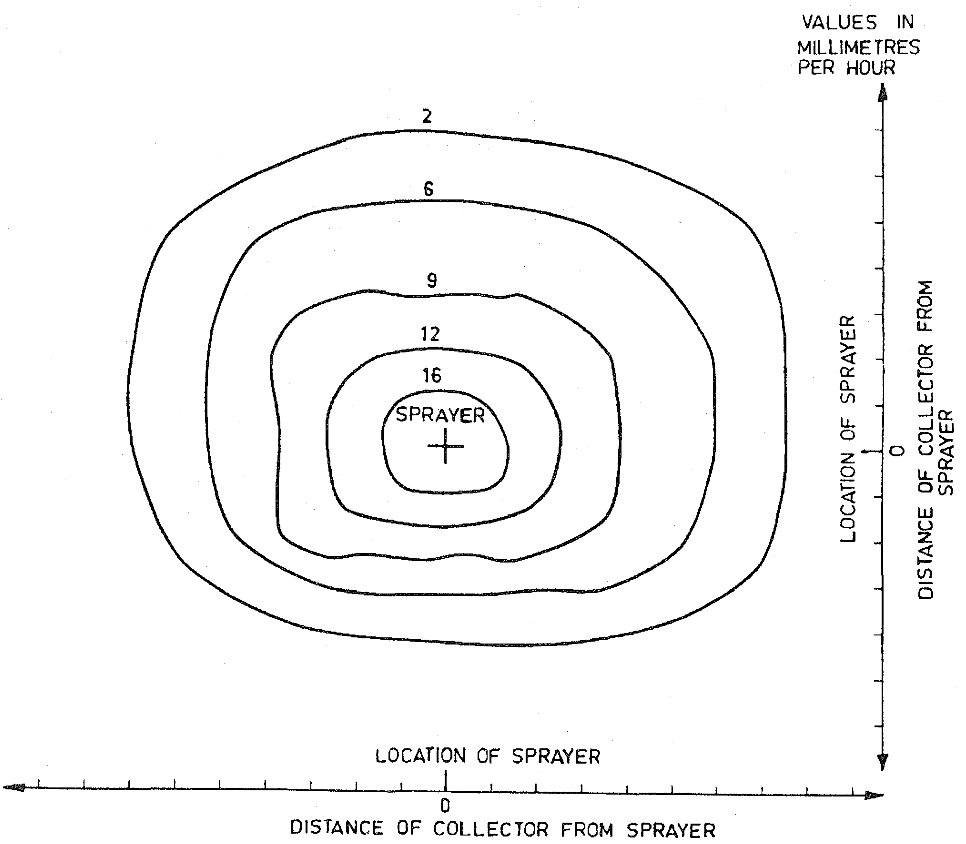


FIG. 6 ISOGRAM OF SPRAY COVERAGE PATTERN, SHOWING LINES OF EQUAL WATER APPLICATION RATES

Compare the water distribution obtained on the spray coverage pattern with that given by the manufacturer.

8.4.4.2 The spray coverage pattern obtained from the test results shall conform generally to the pattern supplied by the manufacturer.

9 DURABILITY TEST

9.1 Test the four sprayers previously tested in **8.3**. Operate the sprayers for 1 500 h at an inlet pressure equal to the test pressure. Conduct the tests using water that has passed through a filter with a mesh as recommended by the manufacturer for normal field conditions or, in the absence of such a recommendation, that has passed through a filter with apertures of 0.4 mm.

9.2 After this period :

a) The measured flow rate of the test sprayer shall remain within ± 10 percent of the initial flow rate; and

b) The sprayer shall show no visible defects on completion of the durability test.

10 MARKING

10.1 Each sprayer shall be clearly and permanently marked with the following information:

a) Name of manufacturer or the manufacturer's registered trade-mark;

b) Catalogue identification symbol or code No.;

c) Nozzle size or nominal flow rate or colour marking of the nozzle indicating the nozzle size or nominal flow rate;

d) Indication of the correct operating position, if necessary.

Replaceable parts, affecting sprayer performance, shall be marked separately. Colours may be used as identifying marks.

If the space on the sprayer is insufficient for all required markings, identification of the manufacturer and the catalogue identification symbol is acceptable, provided that the unmarked specifications are available from the manufacturer.

10.2 BIS Certification Marking

The product may also be marked with the Standard Mark.

10.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

11 DATA TO BE PROVIDED BY MANUFACTURER

The manufacturer shall make available to the user appropriate information on irrigation sprayers in the form of catalogues, instructions or data sheets, all bearing marks of identification and date of issue.

11.1 General Data

a) Catalogue number of irrigation sprayer;

b) Class of sprayer according to **4**;

c) Materials used for manufacture of the sprayer;

d) Instructions for installation and operation;

e) Limitations of sprayer use (fertilizers, chemicals, etc);

f) Instructions for maintenance, storage and repair;

g) List of spare parts, including illustrations; and

h) Instructions for removal of sediment or other materials (such as biological) by means of chemicals.

11.2 Operating Data

a) Nominal flow rate for each nozzle size, l/h;

b) Test pressure, kPa;

c) Range of effective working pressure, kPa;

d) Regulation range for regulated sprayers, kPa;

e) Details of spray coverage pattern by graph or isogram (such as in Fig. 6), or some other form of presentation for Class 4.2.1 sprayers;

f) Performance characteristics (graph of flow rate as a function of pressure);

g) Diameter of coverage, m; and

h) Water outlet height above ground level, recommended by the manufacturer, m.